CLAIMS

What is claimed is:

1. A process for forming a nanosize ceramic powder comprising:

forming a precursor ceramic material comprising a fugitive constituent and a non-soluble constituent in a single phase;

contacting the precursor material a selective solvent to form a solution of the fugitive constituent and a residue of the non-soluble constituent,

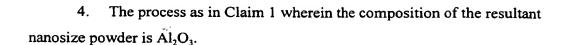
the precursor sufficiently reactive with the solvent to form the solution of the fugitive constituent in the solvent and form the nondissolved residue of the non-soluble constituent

the precursor material and the non-soluble residue sufficiently insoluble in the solvent such that there is insufficient precursor material and non-soluble residue in solution to deposit and precipitate upon the residue of the non-soluble-constituent, the fugitive constituent being sufficiently soluble in the solvent such that the precursor reacts with the solvent to form a solution of the fugitive constituent without

precipitation and deposition of fugitive constituent upon the residue of the non-soluble constituent in the form of nanosize particles;

removing the selective solvent solution from the residue to form a nanosize powder of the non-soluble constituent.

- 2. The process as in Claim 1 wherein the precursor is $BaCe_{(1-X)}RE_XO_{3-\delta}$ or $SrCe_{1-X}RE_XO_{3-\delta}$ and the composition of the nanosize powder is $Ce_{1-X}RE_XO_{2-\delta}$ where RE is a rare earth metal or Y, x is between 0 and about 0.25, and δ is between 0 and about 0.13.
- 3. The process as in Claim 1 wherein the precursor is $BaZr_{1-X}RE_XO_{3-\delta}$ or $BaZr_{1-X}REXO_{3-\delta}$ and the composition of the nanosize powder is $Zr_{1-x}RE_XO_{2-\delta}$ where RE is a rare earth metal or Y, x is between 0 and about 0.25, and δ is between 0 and about 0.13.



- 5. The process as in Claim 3 wherein the precursor is selected from the group consisting of $BaAl_2O_4$, $Ba_3Al_2O_6$, and $NaALO_2$.
- 6. The process as in Claim 1 wherein the composition of the resultant nanosize powder is Cr₂O₃.
 - 7. The process as in Claim 6 wherein the precursor is MgCr₂O₄.
- 8. The process as in Claim 1 wherein the composition of the resultant nanosize powder is ZrO₂.
 - 9 The process as in Claim 8 wherein the precursor is BaZrO₃.
- 10. The process as in Claim 1 wherein the composition of the resultant nanosize powder is TiO₂.
- 11. The process as in Claim 10 wherein the precursor is MgTiO₃, or Mg₂TiO₄.
- 12. The process as in Claim 1 wherein the composition of the non-soluble constituent and the nanosize powder is V_2O_5 .
 - 13. The process as in Claim 12 wherein the precursor is $Na_4V_2O_7$
 - 14. The process as in Claim 1 wherein the selective solvent is water.
 - 15.) The process as in Claim 1 wherein the selective solvent is an acid.
- 16.) The process as in Claim 15 wherein the acid is selected from the group consisting of HNO₃, HCl, H₂CO₃, and H₂SO₄.
- (17.) The process as in Claim 15 wherein the acid is contacted with the precursor with an acid gas.

- The process as in Claim 17 wherein the acid gas is SO₃, N₂O₅, CO₂ or HC1.
- 19.) The process as in Claim 1 wherein the selective solvent is a reacting gas dissolved in a non-aqueous polar solvent.
- The process as in Claim 19 wherein the polar solvent is selected from the group consisting of formamide, N-Methyl-acetamide, N-Methyl-formamide, N-Methyl-propionamide, propylene carbonate, and ethylene carbonate, and the reacting gas is selected from the group consisting of CO₂, SO₃, SO₂, and N₂O₅.

A process for forming a nanosize metallic powder comprising: forming a precursor metallic material comprising a fugitive metal constituent and a non-soluble metal constituent in a single phase;

contacting the precursor material a selective solvent to form a solution of the fugitive constituent and a non-dissolved residue of the non-soluble constituent, the precursor sufficiently reactive with the solvent to form the solution of the fugitive constituent in the solvent and form the non-dissolved residue of the non-soluble constituent

the precursor material and the non-soluble residue sufficiently insoluble in the solvent such that there is insufficient precursor material and non-soluble residue in solution to deposit and precipitate upon the residue of the non-soluble-constituent, the fugitive constituent being sufficiently soluble in the solvent such that the precursor reacts with the solvent to form a solution of the fugitive constituent without precipitation and deposition of fugitive constituent upon the residue of the non-soluble constituent in the form of nanosize particles:

removing the selective solvent solution from the residue to form a nanosize powder of the non-soluble constituent.

- The process as in Claim 21 wherein the precursor is an alloy or an intermetallic compound.
 - 23. The process as in Claim 21 wherein the precursor is PaPd.

- 26 -

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- 24. The process as in Claim 21 wherein the selective solvent is an acid.
- 25. The process as in Claim 21 wherein the selective solvent is HCl.